

SS genotype, bone mineral density at these sites was 5% and 3% lower, respectively, as compared to women with the *SS* genotype. But there's more to the story than just bone density.

According to Ralston, the increase in risk of fracture appears to be related to abnormal composition of the bone. Normal collagen in bone tissue is composed of two alpha 1 chains and one alpha 2 chain. Ralston's data suggest that the *s* allele may cause too many of the alpha 1 chains to be produced, resulting in bone tissue with a lower-than-normal percentage of alpha 2 chains. This makes the tissue unable to cross-link, or mesh, properly, depriving the bone of its usual tensile strength. The bone might therefore look normal and even have a normal density, but could still be structurally weak and vulnerable to fracture.

The symposium was rounded out with presentations on the role of gene-environment interactions in Alzheimer disease, diabetes, and asthma. Coordinator Perry Blackshear, director of clinical research at the NIEHS, said, "We're looking at nurture on top of nature leading to some of these clinical conditions."

Executive Order on Exotic Species

The United States is being invaded by aliens—alien plant, animal, and microbial species, that is. Nonindigenous species, also called exotics, are spreading through the United States, competing with native plants and preying on indigenous animals.

On 3 February 1999, President Bill Clinton signed an executive order to combat this threat, calling for the establishment of a national management plan for invasive species.

Nonindigenous species of weeds, insects, microbes, fish, and invertebrates steal into the United States in innumerable ways: weeds arrive at ports in farming equipment as seeds hidden in soil; aquatic invaders enter estuaries through ship

ballast water; insects, including disease-carrying mosquitoes, slip across national borders in nursery products and on timber and agricultural produce; and microbes can be carried by human travelers. In recent years, international trade and travel have been implicated worldwide in numerous epidemics of infectious diseases including rabies, tuberculosis, dengue, and cholera. In the United States, the non-indigenous diseases with the greatest public health impact are acquired immunodeficiency syndrome (AIDS) and influenza.

Alien species cost the United States \$123 billion a year, according to a 1999 study by Cornell University ecologist David Pimentel and colleagues. Nonindigenous species cause extensive damage to crops, rangeland, wetlands, and aquatic ecosystems.

For example, the green crab, a native of the European North Atlantic coast, arrived in North America in the early 19th century and established itself along the eastern seaboard from New Jersey to Nova Scotia. Since the late 1980s, though, the green crab has spread to

California. Wherever the crab ensconces itself, it eats voraciously, sharply reducing populations of commercially valuable clams and oysters, snails, and other crabs, with an estimated economic impact of \$44 million annually. European purple loosestrife, a weed introduced into the United States in the early 19th century as an ornamental, has spread to 48 states, infesting vast wetland acreage and costing \$45 million a year to fight.

Exotics can pose a serious threat to biodiversity, as well. About 400 of the 958 species on the United States' list of threatened or endangered species are at risk, mostly because of competition or predation by alien species.



Alien attack. Invasive species such as this green crab, shown attacking a cockle, can wreak havoc on sensitive native ecosystems by competing for food and living spaces.

Such invasions "are spinning out of control," says Phyllis Windle, who was project director of a comprehensive 1993 U.S. Environmental Protection Agency Office of Technology Assessment report, *Harmful Non-Indigenous Species in the United States*, and who is now a consultant on nonindigenous species issues. One problem in combating the threat is that responsibility for alien species has been scattered among 22 federal agencies, dozens of state agencies, and several thousand local agencies, Windle notes.

Federal agencies, including the U.S. Fish and Wildlife Service and the Department of Agriculture, have the most responsibility for preventing exotics from entering the country. But once an alien species has established itself and become a nuisance, it falls on understaffed state and local agencies to fight the threat, says Daniel Simberloff, a professor of environmental studies at the University of Tennessee at Knoxville.

Yet state and local officials often fail to compare notes on how they are battling such species. "Many places have similar problems with a species," says Windle, "but people on the ground in various states are not sharing information. There is no excuse, with the Internet available, not to coordinate responses."

Don C. Schmitz, a biologist at the Florida Department of Environmental Protection, says that a lack of communication among states means that "we often miss the window of opportunity to prevent an invader from spreading across state lines." Moreover, there are many species that are native to one part of the United States but alien to another, and states generally lack mechanisms to



prevent introductions from region to region. Meanwhile, the international community has failed to prevent a stream of species from flowing around the world, with the exception of a 1951 agreement to prevent introductions of plant pests.

President Clinton's executive order creates a federal interagency Invasive Species Council whose members include the secretaries of state, treasury, defense, the interior, agriculture, commerce, and transportation, along with the administrator of the U.S. Environmental Protection Agency. The council will develop a comprehensive plan to minimize the economic, ecologic, and human health impacts of invasive species and determine additional steps to prevent their introduction and spread. An advisory committee will provide information for the council, including recommended actions at local, state, and regional levels. The management plan, due in July 2000, will review existing programs and authorities to control nonindigenous species and recommend measures that legislatures and health agencies should take. The council will also establish a study on exotics in federal territories and waters. The council also must find methods of establishing greater international cooperation to prevent species from the United States from invading other countries, while stopping invaders to this country at their sources overseas.

Simberloff is optimistic about the executive order, calling it a good start. The effectiveness of the initiative, he says, partly depends on congressional appropriations. President Clinton's budget for Fiscal Year 2000 proposes an increase of \$28.8 million in funding to fight invasive species. Windle worries that the executive order will be too little too late, and that not enough money will be available for hiring new staff. "People who need [funding]," she says, "are poor, strapped state resource agencies."

The executive order itself is not specific on how the problems of invasive species will be solved. "The machinery it sets up could have a big influence" on slowing the spread of alien species throughout the United States, says Simberloff.

Have Virus, Will Travel

Outdated sewage treatment technology is failing to prevent groundwater and surface waters from being contaminated with human pathogens, according to Joan Rose, a water pollution microbiologist at the University of South Florida at St. Petersburg who studies the movement of waterborne human viruses. In a presentation at the annual meeting of the American



Instructions for Breathing Easier

It is common for air pollutants to be 2–5 times more concentrated inside homes than outdoors, according to the U.S. Environmental Protection Agency (EPA), and sometimes indoor air can be over 100 times more polluted. For many people, the most unhealthy air they breathe all day is indoor air. And, because people may spend as much as 90% of their time indoors, many public health officials are warning people to take steps to reduce their exposure to indoor air pollutants. A 1998 presidential proclamation and the designation of October as Home Indoor Air Quality Awareness and Action Month have helped bring national attention to these issues.

Recently, public health workers from the EPA, the U.S. Department of Agriculture, state agencies, and academia allied themselves to spread information on indoor air pollution and how to avoid the health problems associated with it. The result of their efforts is the Healthy Indoor Air for America's Homes Web site, located at <http://www.montana.edu/wwwcxair>. The site provides information on the most common indoor air pollutants, how to detect and avoid them, and how to educate others about them.

The pollutants that lurk indoors can come from a wide variety of sources including combustion appliances, furnishings, household products, and pets. Because modern, energy-efficient buildings tend to be tightly sealed, with very little fresh air entering from outdoors, these pollutants can reach high levels inside.

Indoor pollutants can lead to a variety of health problems. The formaldehyde found in many sealants and in the adhesive of particleboard can leach into the air and cause fatigue, nausea, and asthma. Invisible radon gas found in bedrock and some building materials may cause lung cancer, while lead from deteriorating paint may hamper the mental development of children.



Healthy Indoor Air for America's Homes

Information on some of the most serious and widespread contaminants of indoor air, including those mentioned above, can be found on the Healthy Indoor Air home page. Available here are brief descriptions of the top 10 indoor air pollutants with links to more detailed fact sheets. The Signs link on the home page leads to a list of ways to tell if a home or office has air quality problems.

Besides providing information about pollutants, the site is also a resource for health care workers and concerned citizens who want to educate their neighbors about indoor air issues. Notes and materials for conducting a series of lectures on indoor air quality are available via the Trainer's Source link on the home page. Details about ordering other teaching materials, including a recently updated manual and video series, are also available here. For those who wish to spread information to the public through local media outlets, the site offers scripts for public service announcements, newspaper ads, and graphics.

The Web site is hosted by Montana State University. More information about the indoor air program and its administrators is available by following the Healthy Indoor Air for America's Homes link on the home page. The information available under this link includes a list of program managers located in each of the 50 states, the District of Columbia, and Puerto Rico who can be contacted by telephone or e-mail for help with indoor air problems.

Other Internet sites that address indoor air pollution are accessible by selecting Lots of Links on the home page. The EPA link takes visitors to that agency's indoor air quality site, where publications are available on additional topics such as how to minimize air quality problems when building a home and what to be aware of when selecting an air cleansing device. Information about the EPA's hotline, which gives people live access to indoor air quality experts, is also available on this site. Other external links take visitors to information about lead poisoning (supplied by the U.S. Department of Housing and Urban Development) and to Home*A*Syst, a University of Wisconsin site dealing with pollutants and health hazards in the home.